

Hymenoptera from caves of Bakony Mountains, Hungary – an overlooked taxon in hypogean research

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Abstract

There are no known troglobiotic hymenopterans, although a few species regularly occur in caves, usually for an inactive phase of their life-cycles. During a recent faunistical survey of the invertebrate fauna of Bakony Mountains' caves (Hungary) several Hymenoptera specimens were collected in hypogean environments. In this paper we report the results of the survey regarding Hymenoptera. Although the Hymenoptera material was small in numbers, they provided valuable faunistical data: very rare or rarely collected species were found, and 5 taxa are first reported from hypogean environment. *Aclastus longicauda* Horstmann (Ichneumonidae: Cryptinae) was found new to the Hungarian fauna, considerably extending the distributional area of this species that has been known only from Northern Europe so far. Our local results clearly indicate that, both at local and world-wide level, research focusing on the usually overlooked Hymenoptera fauna of caves will certainly provide valuable faunistical, distributional and biogeographical data.

Keywords

Aclastus, Ichneumonidae, Braconidae, Proctotrupidae, Embolemidae

Introduction

There are no known troglobiotic hymenopterans, although a relatively few species are known to regularly occur in caves, usually for executing an inactive phase of their life-cycle. From the hundreds of thousands described hymenopteran species only about 200–250 species

have been reported to be associated with hypogean environments (see e.g. Decu et al. 1998, Moldovan 2004). Presumably this number is greatly underestimated due to the following reasons: (i) usually zoologists studying troglobiotic animals are not specialized in Hymenoptera, hence do not consider to collect and/or identify the hymenopterans, as they are not troglobiotic animals; (ii) Hymenoptera specialists usually do not collect in hypogean environments; and (iii) even if there is collected material, there are relatively few specialists who are able to reliably identify the specimens of the most commonly collected, very diverse groups of parasitoid wasps. For these reasons, the literature on Hymenoptera of cave environments is rather scarce and sporadic. The aim of this work is to contribute to the knowledge the Hymenopteran fauna of Middle European caves, and to facilitate future studies by drawing the attention to this poorly discovered topic.

In 2009 the Bakony Museum (BM) of the Hungarian Natural History Museum (HNHM) and the local caver clubs started to investigate the cave fauna of the Bakony Mountains (Veszprém County, Hungary). Some of these caves were never studied before by zoologists. The results have already been reported in some parts (see e.g. Szabó et al. 2013, Disney 2014, Novák and Kutasi 2014). Several Hymenoptera specimens were also collected in these hypogean environments; in this paper we report the results of the survey regarding Hymenoptera.

Methods

Between 2009 and 2012 invertebrates were collected in five caves in the Bakony Mountains. The studied caves belong to the authority of the Balaton-felvidéki National Park, and they are partly open to the public (Fig. 1).

The Csodabogyós Cave (46°47.822'N; 17°21.873'E, ca 400 m, investigated between 17 December 2009–13 January 2011, and 22 July–5 October 2011) is situated at Balatonederics, in the Keszthely Mts. which is part of the Bakony Mts. The cave was formed in the Late Triassic period in Ederics Limestone formation. It is a 5200 m long and 121 m deep cave with a multi-level system of fissures. The cave chambers are decorated with various dripstone formations, therefore it has been strictly protected since 1992 (Kárpát 2003, Anonymous 2012).

The Lóczy Cave (46°58.140'N; 17°52.409'E, ca 250 m, investigated between 25 November 2010–26 March 2012) is near Balatonfüred. It was discovered in 1882. The 154 m long and 15 m deep cave was formed by upwelling thermal water in Füred Limestone in the Late Triassic period, and it is strictly protected since 1982 (Hazslinszky 2003, Anonymous 2012). The Takó Cave (47°11.702'N; 17°54.974'E, ca 350 m, investigated between 6 March 2009–30 January 2010) is near Eplény; it is a 60 m long limestone cave (Anonymous 2012).

The Kölik Cave (47°06.105'N; 17°44.892'E, ca 370 m, investigated between 25 March 2011–25 October 2012) is situated at Szentgál; it is 420 m long and 39 m deep. This limestone cave is strictly protected since 1993 (Anonymous 2012). The Kapolcsi Pokol Hole (46°56.823'N; 17°35.302'E, ca 270 m, investigated between 28 March

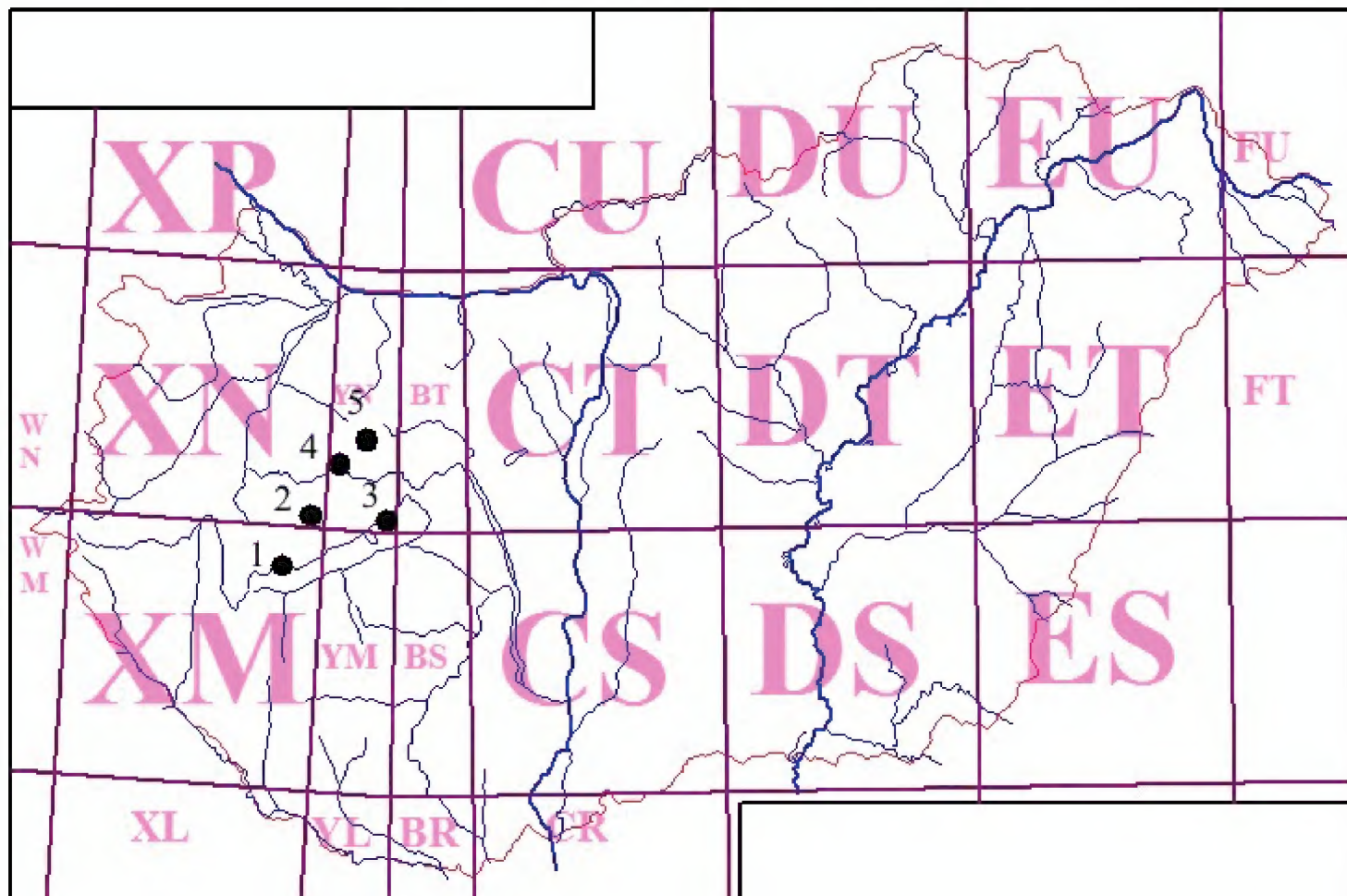


Figure 1. Location on the studied caves in Hungary: **1** Csodabogyós Cave (Balatonederics) **2** Pokol Hole (Kapolcs) **3** Lóczy Cave (Balatonfüred) **4** Kőlik Cave (Szentgál) **5** Takó Cave (Veszprém).

2012–22 May 2013) is a 56 m long tectonic basalt cave. The thick basalt blocks the seeping water, which therefore emerges as a spring.

The invertebrates were collected by 250 cm³ volume pitfall traps filled with ethyleneglicol in each cave. Traps were situated from the entrance of the caves till the last approachable parts; average number of traps was 15 per caves, and they were working for a year. Stinking cheese was used as bait material.

The collected Ichneumonidae, Proctotrupidae and Embolemidae material was identified by the first author using a Nikon SMZ645 stereoscopic microscope; a specimen belonging to Braconidae was identified by Dr. Jenő Papp. The identification was based on keys provided by Hellén (1941), Constantineanu (1959), Townes et al. (1965), Townes (1970, 1971), Pschorn-Walcher (1971), Horstmann (1980), Townes and Townes (1981), Wahl (1993), Achterberg and Kats (2000), and Broad (2011). Earlier records of the species in the Hungarian fauna were checked in Mocsáry (1886, 1897), Olmi (1999), Papp (2005), and Yu et al. (2012). The material is deposited in HNHM.

Results and discussion

Below we list the species found in the caves of Bakony Mountains. Taxa are listed in alphabetical order. Distributional and biological and/or taxonomical remarks are

given following the collecting data of each species. English translations of the names of rooms and branches within the caves are given in brackets. Distance of the collecting site from the cave entrance is abbreviated as DFE.

Chrysidoidea: Embolemidae

***Embolemus ruddii* Westwood, 1846**

Material examined. Hungary, Veszprém County, Balatonfüred, Lóczy Cave, Középső-kar [Middle-branch], DFE: 50 m, 29 April 2011–28 June 2011, leg. L.T. Katona & Cs. Kutasi, 1 ♀; same location, 25 September 2011–26 March 2012, leg. Zs. Csermák, L.T. Katona & Cs. Kutasi, 1 ♂; Hungary, Veszprém County, Szentgál, Kőlik Cave, Bagolyvár [Castle of the Owl], DFE: 16 m, 27 November 2011–24 March 2012, leg. Zs. Csermák & L.T. Katona, 1 ♀.

Remarks. Little is known about the biology of this widespread but rare Palearctic species. Based on rearing data from relatives might be a parasitoid of homopteran larvae (Olmi 1999); however, there are several observations which suggest some relation to ants (Achterberg and Kats 2000). The wingless females regularly occur in mole and ant nests, and under stones; however, this species has also been reported from caves (Sebald and Weber 2013). It is known that females overwinter as adults (Gauld and Bolton 1988); considering collecting dates, they might hibernate in the caves.

Ichneumonoidea: Braconidae

Subfamily: Blacinae

***Blacus longipennis* (Gravenhorst, 1807)**

Material examined. Hungary, Veszprém County, Kapolcs, Pokol Hole, DFE: 4 m, 5 July 2012–13 November 2012, pitfall traps no. 1–3, leg. Cs. Kutasi, 1 ♀.

Remarks. Widespread Palearctic species, and an endoparasitoid of coleopteran hosts (Anobiidae, Cerambycidae) (Yu et al. 2012). This species is first reported here in association with hypogean environment; some members of this genus are known to overwinter as adults (Johnson 1920); it might be a reason of its presence in caves.

Ichneumonoidea: Ichneumonidae

Subfamily: Cryptinae

***Aclastus longicauda* Horstmann, 1980**

Material examined. Hungary, Veszprém County, Balatonfüred, Lóczy Cave, Felső-terem [Upper-room], DFE: 38 m, 11 June 2011–25 September 2011, leg. Zs. Csermák, 1 ♀.

Remarks. First record in the Hungarian fauna. This species has been described from Sweden (Horstmann, 1980), and besides Sweden it has only been reported from Finland (Jussila, 1989) so far. The presence of this species in Hungary suggests a much more widespread distribution within Europe than it was apparent before. Additionally, this species is first reported here in association with hypogean environment. No particular host of *Aclastus longicauda* is known; however, based on data from close relatives it might be an idiobiont parasitoid of spider egg sacs (e.g. Amaurobiidae, Linyphiidae, Micryphantidae) (Horstmann 1980, Finch 2005, Yu et al. 2012). This phenomenon also could explain its occurrence in caves: it may search for spider eggs sacs there.

Subfamily: Ichneumoninae

Diphyus quadripunctorius (Müller, 1776)

Material examined. Hungary, Veszprém County, Balatonederics, Csodabogyós Cave, Poroltó [Fire Extinguisher], DFE: 6 m, 17 December 2009–27 February 2010, leg. L.T. Katona, 3 ♀♀; same location, 27 February 2010–5 June 2010, leg. L.T. Katona, 1 ♀; same location, 5 June 2010–19 October 2010, leg. L.T. Katona & Zs. Csermák, 3 ♀♀; Hungary, Veszprém County, Szentgál, Kölik Cave, Felső-terem [Upper-room], DFE: 3 m, 25 March 2011–29 July 2011, leg. L.T. Katona & A. Piri, 1 ♀; same cave, Cseppköves-terem [Dripstones Hall], DFE: 8 m, same date and collectors, 1 ♀; same cave, Nagy-terem [Great Hall], DFE: 9 m, same date and collectors, 1 ♀; same cave, Cseppköves-terem [Dripstones Hall], DFE: 8 m, 27 November 2011–24 March 2012, leg. Zs. Csermák & L.T. Katona, 1 ♀; same cave, Nagy-terem [Great Hall], DFE: 9 m, same date and collectors, 1 ♀.

Remarks. Common and widespread species throughout the Western Palearctic region (Yu et al. 2012); the most common hymenopteran found in European caves and artificial subterranean environments such as cellars (Novak et al. 2010). This species is a parasitoid of various caterpillar hosts (mainly Noctuidae and Geometridae), and females overwinter as adults (Constantineanu 1959, Yu et al. 2012).

Eutanyacra jucunda (Kriechbaumer, 1882)

Material examined. Hungary, Veszprém County, Kapolcs, Pokol-Hole, DFE: 4 m, 5 July 2012–13 November 2012, pitfall traps no. 1–3., leg. Cs. Kutasi, 1 ♀.

Remarks. A very rare species described and known only from the Carpathian Basin (Kriechbaumer 1882, Mocsáry 1886, Constantineanu 1959). This species is first reported here in association with hypogean habitat. No specific details are known about its biology; however, other *Eutanyacra* species are parasitoids of various caterpillar hosts (mainly Noctuidae), and the females overwinter as adults (Constantineanu 1959, Rasnitsyn 1964, Yu et al. 2012).

Subfamily: Ophioninae***Ophion obscuratus* Fabricius, 1798**

Material examined. Hungary, Veszprém County, Péntesgyőr, Tilos-erdei Cave, 1 December 2013, leg. S. Tóth, 1 ♀.

Remarks. This specimen has already been reported, however misidentified as *Ophion luteus* (Linnaeus, 1758), by Tóth (2015). Hence, we publish the correction of that record here. *Ophion obscuratus* is a common and widespread species throughout the Western Palearctic region (Yu et al. 2012). This species is a nocturnal koinobiont endoparasitoid of various lepidopteran hosts (e.g. Györfi 1943, Brock 1982). The autumn generation can be found on the wing in autumn, winter, and early spring. Its presence in caves might be due to overwintering. To our best knowledge this species is first reported here in association with hypogean environment.

Subfamily: Orthocentrinae***Stenomacrus* sp.**

Material examined. Hungary, Veszprém County, Balatonederics, Csodabogyós Cave, Óriás-terem [Giant-hall], DFE: 38 m, 17 December 2009–27 February 2010, leg. L.T. Katona & Cs. Kutasi, 1 ♀; same cave, Függőkert [Hanging Garden], DFE: 60 m, same date and collectors, 1 ♀; same cave, 5-ös terem [5-room], DFE: 58, same date and collectors, 1 ♀; same cave, Bezengő [Sounding], DFE: 50 m, same date and collectors, 1 ♀; same cave, Szív-terem [Heart-hall], DFE: 35 m, 27 February 2010–5 June 2010, leg. L.T. Katona, 1 ♀; same cave, Meseország [Wonderland], DFE: 45 m, same date and collectors, 1 ♀; same cave, Feneketlen hasadék lejárata [Entrance of Bottomless Chasm], DFE: 30 m, 5 June 2010–19 October 2010, leg. L.T. Katona & Zs. Csermák, 1 ♀; same cave, Szív-terem [Heart-hall], DFE: 35 m, 22 July 2011–5 October 2011, leg. L.T. Katona & Cs. Kutasi, 4 ♀♀; same cave, Óriás-terem [Giant-hall], DFE: 38 m, same date and collectors, 1 ♀; same cave, Meseország [Wonderland], DFE: 45 m, same date and collectors, 1 ♀; Hungary, Veszprém County, Szentgál, Kőlik Cave, Felső-terem [Upper-room], DFE: 3 m, 25 March 2011–29 July 2011, leg. L.T. Katona & A. Piri, 1 ♀.

Remarks. Since Aubert (1981)'s revision no comprehensive identification key has been published to the genus, although several new species have been described from Europe (e.g. Kolarov 1986, Jussila 1996). Currently, 50 species of the genus are known from Europe (Yu et al. 2012). By using Aubert (1981)'s key the species found in the caves could not be convincingly identified. They seem to be close to *Stenomacrus laricis* (Haliday, 1838); however, reliable identification might not be possible without a new revision of the Western Palearctic species of the genus. Based on some rearing records

Stenomacrus species seems so be larval and/or pupal endoparasitoids of Sciaridae and Mycetophilidae (Townes 1971, Gauld and Bolton 1988). To our best knowledge this genus is first reported here in association with hypogean environment.

Proctotrupoidea: Proctotrupidae

Exallonyx longicornis (Nees, 1834)

Material examined. Hungary, Veszprém County, Veszprém, Takó Cave, DFE: 8 m, 8 July 2009–18 November 2009, leg. Cs. Kutasi & L.T. Katona, 7 ♀♀; same location, 18 November 2009–5 December 2009, same collectors, 1 ♀.

Remarks. *Exallonyx longicornis* is the most common proctotrupid wasp found in European caves; the females execute there their summer and winter rest in large abundance (Novak et al. 2010). This species is an endoparasitoid of rove beetles (Staphylinidae) (Gauld and Bolton 1988).

Conclusions

Although no troglomorphic hymenopteran species are known, our results suggest that more species are associated with hypogean environment for a shorter or longer phase of their life-cycles than expected. The most probable explanation is that troglomorphic faunistical surveys rarely consider to collect and/or identify the hymenopteran specimens from caves as they are regarded as outsiders of the cave environments. Nevertheless, not only some very rare wasp species (such as *Eutanyacra jucunda*) were found in the caves of Bakony Mts., but this material greatly extended our knowledge of the geographical distribution of an ichneumon wasp species (i.e. *Aclastus longicauda*), and 5 hymenopteran taxa were recorded from cave environment for the first time. Our local results clearly indicate that, both at local and world-wide level, research focusing on the Hymenoptera fauna of caves will certainly provide valuable faunistical, distributional and biogeographical data.

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